BOOK REVIEWS

Theoretische Metallkunde. By ULRICH DEHLINGER, Professor an der Technischen Hochschule Stuttgart, Abteilungsleiter am Max Planck-Institut für Metallforschung. (Reine und Angewandte Metallkunde in Einzeldarstellungen, Vol. 13). Springer-Verlag, Reichpietschufer 20, Berlin W 35 (West-Berlin), Germany. 1955. v + 250 pp. 16 × 23.5 cm. Price, Ganzleinen DM 27.

The literal equivalent of the title of this book—"Theoretical Metallurgy"—does not, at present, have a well-defined or conventionally accepted meaning in English, but may be understood to designate the fundamental science of metals and alloys. This science comprises the atomic theory of metals and alloys, their crystallography and structure, the thermodynamics and kinetics of reactions in metallic systems and theories of the physical properties of metals. The book reviewed here undertakes to cover this large field in a very concentrated manner and, on the whole, does so successfully. The author's preparation for this undertaking includes much original work in metal physics and contributions to the literature such as the section on crystallography in Masing's "Handbuch der Metallphysik" (1935) and a small book on the chemical physics of metals (1939).

The text consists of six parts, which are subdivided into twenty-five chapters, and is supplemented by extensive tables. A detailed bibliography serves as partial documentation and as a list for further reading. Over eighty figures add greatly to the interest of the book.

Part I introduces crystallographic fundamentals, including the reciprocal lattice, point and space groups and an analysis of diffraction phenomena. Part II deals with the electrons in the crystal lattice. The contents and approach are indicated by the chapter headings: (1) The Electron Gas in the Lattice Potential, (2) The Fermi Statistics of the Electron Waves, (3) Brillouin Zones and the Hume–Rothery Rule, (4) Atomic Orbitals and Electron Bands, (5) The Cell Method and (6) The Correlation of the Electrons and the Distribution of Spins.

Part III analyzes the structures of the metallic elements in terms of binding forces and contains also a chapter on the transition metals and their polymorphic transformations. Part IV deals with the energetics of the formation of alloys and their crystal structures. Chemists may find this section of greatest interest.

Part V on physical properties consists of chapters on (1) electrical conduction and the Hall effect, (2) magnetism and (3) optical properties and X-ray spectra. Part VI, entitled "Phase Equilibrium and Transformation Kinetics," is subdivided into eight chapters on the following subjects: (1) statistical mechanics, (2) specific heat of lattice vibrations, (3) internal and external equilibrium of phases, (4) diffusion, nucleation and crystal growth, (5) precipitation in supersaturated solid solution crystals, (6) reactions associated with moving dislocations, (7) lattice defects, grain boundaries and surfaces and (8) relaxation phenomena.

Coverage of so much material in a book of modest size has been achieved by a skillfully written, though very condensed text, which makes free use of higher mathematics and theoretical physics. The tables present not only physical constants but calculations and expository matter and supply much information in compact form. The occasional references in the text to subsequent sections, however, seem to carry the striving for brevity rather far.

In a work as comprehensive as this, some portions inevitably do not come up to the level of the rest. Different readers will single out different sections for such criticism. To this reviewer, the discussion of the newer theories of bonding (in Parts III and IV) seems to be the least successful major section of the book. Insufficient detail on mechanical properties and behavior constitutes the main omission. Among limited points for criticism are the treatment of Brillouin zones, which lacks clarity, and an unsatisfactory approach to the laws of thermodynamics (page 127f). Such defects, however, are minor when held against the merits of this systematic and stimulating account of an enormous amount of material, much of which is inherently difficult and some of which is still quite new.

In summary, Dehlinger's "Theoretische Metallkunde" is a distinct accomplishment and a notable addition to the literature. While it is too concise to serve as an introduction for beginners, it may have usefulness for mature students in conjunction with more detailed texts. The book should be of greatest interest and value to readers who possess already some knowledge of the science of metals or who are trained in some related discipline.

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Methoden der Organischen Chemie (Houben-Weyl). Band IX. EUGEN MÜLLER, Editor. Schwefel-, Selen-, Tellur-Verbindungen. By M. BÖGEMANN, H. BÖHME, H. ECKOLDT, J. GOERDELER, F. MUTH, S. PETERSEN, M. QUAEDVLIEG, H. RHEINBOLDT, A. SCHOBERL, A. SHÖNBERG, O.-E. SCHULTZ, H. SÖLL and A. WAGNER. Georg Thieme Verlag, Stuttgart, Germany. 1955. xxxi + 1337 pp. 18.5 × 26 cm. Price, DM 218.-.

Volume IX of this monumental series, the resumption of which the writer was privileged to discuss for the JOURNAL in 1953, has now appeared. It is devoted to compounds of sulfur, selenium and tellurium. The section dealing with the two last-named elements is presented in an "intentionally monograph-like fashion because no such treatment exists in the literature."

The great variety of classes of substances are arranged according to increasing oxidation level of sulfur, beginning with the mercaptans and their relatives, over sulfonium compounds, sulfoxides, sulfenic and sulfuric acids to sulfonic acids and finally to thio-aldehydes, -ketones and -acids. An impressive list of contributors, from both academic and industrial institutions, has again been assembled, and this reviewer would consider himself presumptive were he to attempt a critical appraisal of the writing of specialists. However, a few general remarks may be of interest. The brief introductory sections to each chapter include, as a rule, modern concepts of structure, valence and mechanistic interpretation. Coverage of the literature, though admittedly and necessarily selective, appears to be very thorough. The extensive treatment given aromatic sulfonic acids and their derivatives is a very gratifying feature, because the plentiful information existing on, to name just one example, the sulfonation of the naphthylamines, has been disinterred and collected from widely dispersed and not universally accessible sources. A brief section at the end of the book endeavors to outline, and then to clarify, the problems of the nomenclature of sulfur compounds. The book will be of greatest aid to anyone doing experimental work on organic compounds of sulfur, selenium and tellurium, be it by providing actual preparative directions or by providing points of departure for planning new procedures.

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